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HERCULES

CHEMICAL PROPULSION DIVISION
HERCULES POWDER COMPANY
INCORPORATED
BACCHUS WORKS MAGNA, UTAH

Technical Operating Report
B O B Approval Number

MOTOR STORAGE STUDIES PROGRAM PLAN
PHASE I, MOTOR STORAGE PROGRAM
MTO-258-3

VOLUME I

WEAPON SYSTEM 133A

17 June 1963

Contract Number AF 04(647)-243
Exhibit B, Paragraph III.F.5
Exhibit D, Sect. III, Para D.9
Contract Change Notification No. 108

Contract Number AF 04(694)-127
Exhibit A, Sect. II, Task 13

Prepared by

HERCULES POWDER COMPANY
CHEMICAL PROPULSION DIVISION
Bacchus Works
Magna, Utah

Prepared for

HEADQUARTERS
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
Los Angeles, California

Report Number MTO-258-3

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Date 17 June 1963

MOTOR STORAGE STUDIES PROGRAM PLAN
PHASE I, MOTOR STORAGE PROGRAM

VOLUME I

WEAPON SYSTEM 133A

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FOREWORD

This document presents Volume I of the Motor Storage Studies Program Plan.

Authority and requirements for motor storage studies, Wing I motors, is established in Contract AF 04(647)-243, Exhibit B, paragraph III.F.5, and Exhibit D, Section III, paragraph D.9, and CCN No. 108, 165, and 200. Motor Storage studies for Wing II and Wing IV motors is authorized by Contract AF 04(694)-127, Exhibit A, Section II, Task 13. Motor storage studies for Wing VI motors is authorized by Contract AF 04(694)-270, Exhibit B, paragraph IV.E.3.

To comply with contractual requirements the overall program has been divided into (1) a motor storage phase and (2) a surveillance support phase. For purposes of program planning and presentation, publication of the Motor Storage Studies Program Plan has been arranged as follows:

(1) Phase I: Motor Storage Program

  (a) Volume I: Motor Storage Program, Wing I, Wing II, and Wing IV motors

  (b) Volume II: Motor Storage Program, Wing VI Motors

(2) Phase II: Surveillance Support Program

  (a) Volume III: Surveillance Support Program, Wing I, Wing II, and Wing IV Motors

  (b) Volume IV: Surveillance Support Program, Wing VI Motors

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ABSTRACT

The Motor Storage Program, set forth in this document, uses a total of 15 Wing I, 6 Wing II, and 4 Wing IV stage III Minuteman rocket motors. A master schedule, giving casting, storing, and firing dates and other details, shows that the different motors will undergo storage periods varying from 1 to 10 yr. Storage will be in conditions simulating operational environment.

The program is composed of 11 steps that include, along with storage, transportation conditioning, test firing, inspections at various times, and, finally, analysis and evaluation. The program is designed to evaluate the storage capability of the stage III Minuteman motor under operational conditions, and ultimately to aid in the prediction of the usable life of the operationally deployed motor.

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SECTION I

INTRODUCTION

A. CONTRACTUAL REQUIREMENT FOR STORAGE MOTORS

1. Wing I R & D Motors. Direction to Hercules Powder Company for developing and maintaining a Motor Storage Studies (Aging) Program for the Minuteman Wing I stage III rocket motor is contained in Exhibits B and D to Contract AF 04(647)-243. Contract Change Notification (CCN) No. 108, dated 6 April 1962, required Hercules to support the development program to demonstrate the storage capability of the stage III motors in an operational environment. It should be noted that while CCN No. 108 authorizes 20 M-57 storage motors, AFBSD has amended this total to 15 by TWX BSRPS-3-22-8-209, dated 23 August 1962.

2. Wing II and Wing IV Motors. Authority for conducting the storage, inspection, conditioning, and testing of the Wing II and Wing IV storage motors is contained in CCN No. 108 to Contract AF 04(647)-243. The authority for manufacturing six Wing II and four Wing IV replacement motors is contained in Exhibit A, Section II, Task 13, to Contract AF 04(694)-127.

B. SYNOPSIS OF MOTOR STORAGE PROGRAM, WING I

The Motor Storage Studies Program will be accomplished by a scheduled placement of 15 Wing I rocket motors in storage at Hill Air Force Base (HAFB), Utah, for various storage periods, under environmental conditions simulating the hardened and dispersed conditions for the WS-133A Operations Weapon System. To implement the Motor Storage Program, periodic inspections and tests will be conducted during and following the storage period to determine the development of possible failure modes, and to evaluate performance of the aged motors.

C. SYNOPSIS OF MOTOR STORAGE PROGRAM, WING II AND WING IV

The Wing II and Wing IV, Follow-On, Storage Program consists of storing, periodically inspecting, conditioning, and static testing a total of 10 Wing II and Wing IV Minuteman stage III motors. Motors for the program will be procured as described in paragraph B.7, Section III; they will have been procured under Contract AF 04(647)-127. Implementation of the program will basically follow that described for Wing I motors.

D. SYNOPSIS OF THE SURVEILLANCE SUPPORT PROGRAM (PHASE II)

Phase II of the Motor Storage Studies Program Plan, Surveillance Support Program, complements and supports the Motor Storage Program by providing data from components and subassemblies stored independently of the motor, under a variety of conditions approximating hardened and dispersed environmental conditions.

E. REFERENCE DOCUMENTATION

Documents referenced in connection with the Motor Storage Studies Program Plan are listed below:

(1) Space Technology Laboratories (STL) Document, GM 61-9734.2-1045, Guide for Aging Program, Full-Scale Minuteman Motors, Revision 1, dated 2 October 1961, is being used by Hercules for planning purposes.

(2) Applicable matter from Hercules Report MTO-101C, Minuteman Stage III Motor Master Test Plan, Surveillance/Storage Program, Revision 3, dated 31 March 1962, rescinded 15 October 1962, has been incorporated in the Motor Storage Studies Program Plan. SOP- SIP-type material in MTO-101C will be replaced by a Surveillance Program Procedures Manual to be published approximately December 1963.

(3) Hercules Report MTO-208, Request for Surveillance-Storage Test Unit SP8-163, WS 133A, dated 22 December 1961, exemplifies periodic formal requests for the surveillance storage testing of specific storage motors. This report constitutes the ninth "test request" for a storage unit under the Hercules Motor Storage Program.

(4) Appropriate portions of Hercules Report MTO-4-3, Surveillance Program, Revision 3, dated 10 September 1960, rescinded, have been incorporated into this program plan.

(5) Hercules Report MTO-25-3, Preliminary Flight Rating Test Plan, Rocket Engine XM-57, dated 30 September 1960, as amended by incorporation of applicable pages of Report MTO-25-4, Revision 4 to the Preliminary Flight Rating Test Plan, dated 25 October 1960, is being used in conjunction with individual motor test plans for implementation of the storage motor Test Firing Program.

(6) Hercules Technical Manual, HPC-133-03-5-1, Transportation and Handling of Minuteman M-57E1 Third Stage Rocket Motor, dated 1 May 1962, serves as a reference in connection with handling and transporting storage motors.

(7) Hercules Report MTO-313, Wing II Qualification Test Plan, dated 15 January 1963, will be used as a guide for preparing the individual Wing II and Wing IV motor test plans for implementation of the storage motor Test Firing Program.

(8) Wing II model specification S 133-1003-0-1, dated 28 February 1963 (or latest revision), will be used for comparing ballistic and component data derived from the Wing II and Wing IV storage motor static firings.

SECTION II

TASK REQUIREMENTS

A. TASK REQUIREMENTS, WING I R & D MOTORS

1. General

a. Statement of Tasks. The following tasks represent Hercules summation of the Motor Storage Studies Program Plan requirements set forth in the Work Statement for Exhibits B and D, as amended, to Contract AF 04(647)-243.

	Task	Authorization
(1)	Incorporate within the Program Plan a Motor Storage Studies Plan to demonstrate the storage capability of the motor, differentiating between on-plant and off-plant effort.	Exhibit B, paragraph III.A.5
(2)	Describe Hercules plan dor conducting a Motor Storage Program for full-scale units at HAFB, Utah.	Exhibit B, paragraph III.F.5 as amended by CCN No. 108, and Exhibit D Sect. III D.9.
(3)	Describe Hercules plan for conducting a comprehensive Motor Storage Laboratory (Surveillance Support) Program at Bacchus Works, using propellant and motor component samples, subassemblies, and subscale prototype rocket motors.	Same authority as in (2) above

b. Summary of Tasks Completed. Implementation of motor storage study techniques is a continuing process; therefore, none of the listed tasks have been completed. The Motor Storage Studies Program has been continuous since inception.

c. Plan for Accomplishing Tasks. Hercules plan for accomplishing each task is set forth in paragraphs 2 through 4 below.

2. Task (1). A Motor Storage Studies Plan, designed to demonstrate the storage capability of the motor, has been divided into Motor Storage Program (off-plant) and Surveillance Support Program (on-plant). In compliance with a work statement request to submit a proposed Motor Storage

Plan utilizing a maximum of 20 stage III motors to BSD by 15 March 1961 for approval, Hercules submitted MTO-4-3, Engine Storage Plan (Surveillance Program, Revision No. 3), dated 10 September 1960, and MTO-101, Master Test Plan for Surveillance/Storage Programs, dated 3 March 1961. This latter document was revised by submission of MTO-101A, MTO-101B, and MTO-101C. (Refer to Section I, paragraph E.2.)

3. Task (2).

a. Overall Storage Program Objectives. The overall objectives of Hercules Motor Storage (Aging) Program are to evaluate the storage capabilities of the stage III Minuteman rocket motor under environmental conditions representative of the operational concept, and ultimately to aid in the prediction of the usable life of the operationally deployed motors. Specific objectives of the program are:

(1) To obtain early data on the useful and safe storage life of the M-57 rocket motor

(2) To determine the reliability degradation of aged motors

(3) To determine parts failure and the replacement and rework intervals to be used in determining field recall and service intervals for the operational missile

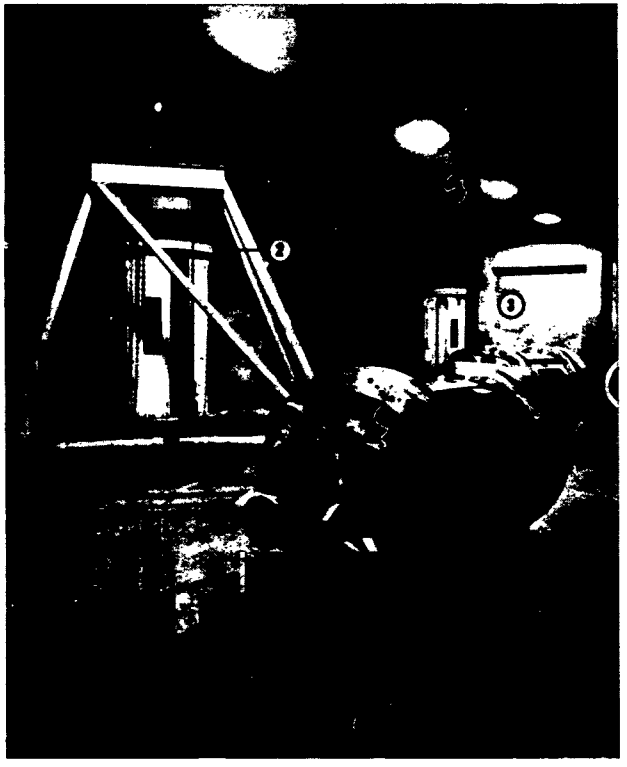
(4) To determine the effect of transportation on the motor after periodic intervals of storage

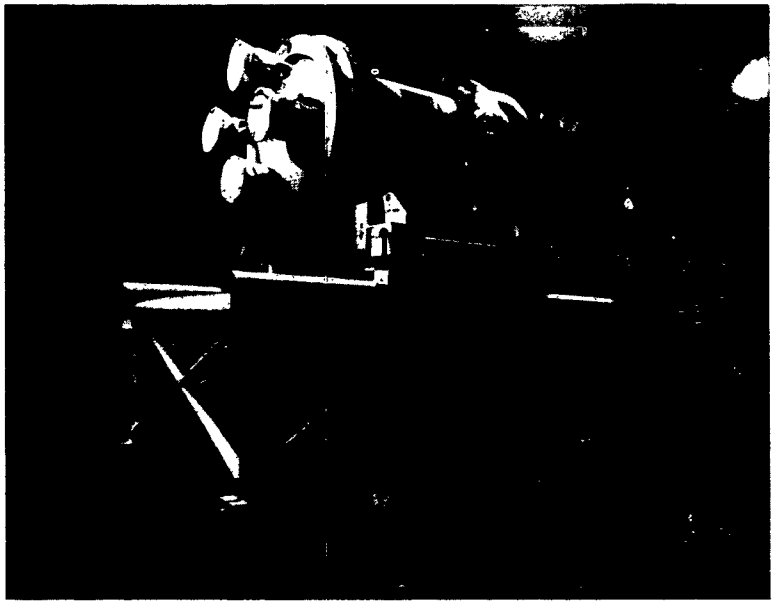
b. General Implementation Plan for Motor Storage Program. The Motor Aging Program will be accomplished by placing M-57 rocket motors in vertical and horizontal storage attitudes in modified, temperature- and humidity-controlled igloos under environmental conditions simulating the hardened and dispersed surroundings of the WS-133A operational weapon system. (See Figures 1 and 2.) During storage, periodic visual inspection of the motor will take place. Tests will be conducted, following the storage period, to determine the occurrence of failure modes and to evaluate the performance of aged motors.

c. Utilization of Air Force Storage Facilities. The storage motors described in this program plan are stored at HAFB, Utah, in Buildings 1832, 1833, 1834, 1835, 1825, and 1826. This storage arrangement complies with paragraph III.F.5, Exhibit B, Contract AF 04(647)-243, as amended by CCN No. 108.

d. Duration of Storage Program. The Motor Storage (Aging) Program has been planned for a 10-yr period, based on Air Force assumption of completely satisfactory motor performance for the period. The program's duration may be reduced, since its intent is to find out by test firing the motor's storage capability. The test firing will be, as required, to confirm or deny that a detected failure is due to aging. Storage motors will also be used, as required, to identify modes of failure and the extent of degradation.

MOTOR STORAGE AND HANDLING EQUIPMENT

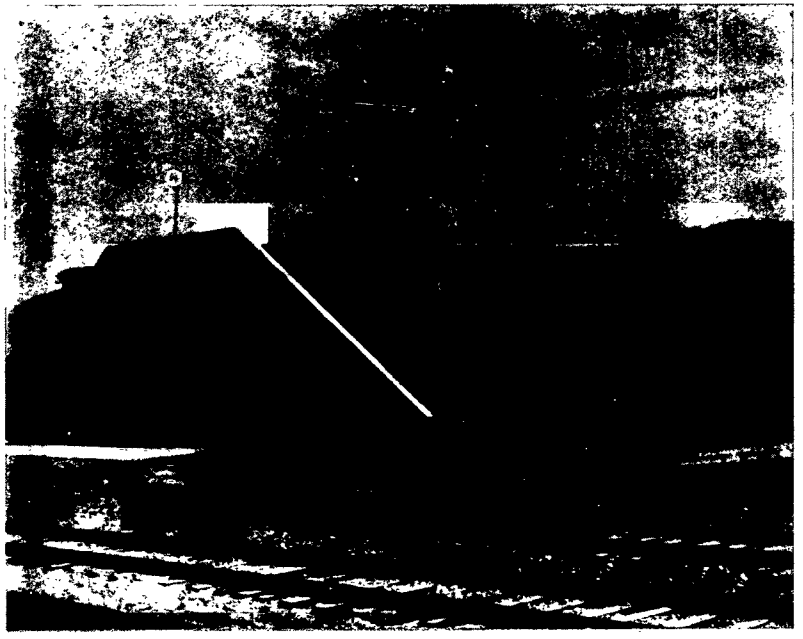




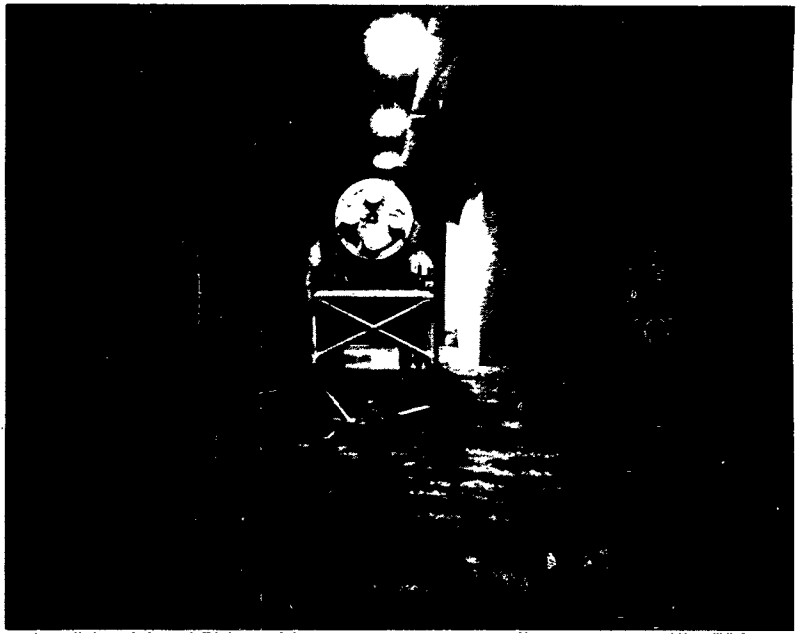
1. PORTABLE TRANSFER STAND POSITIONED OVER VERTICAL MOTOR
2. SIMULATED RE-ENTRY PACKAGE
3. LOADED MOTOR IN VERTICAL STORAGE ATTITUDE
4. SURVEILLANCE HARNESS ENCOMPASSING LOADED MOTOR IN HORIZONTAL STORAGE ATTITUDE
5. VERTICAL SURVEILLANCE HARNESS
6. MODIFIED BOEING COMPANY SHIPPING HARNESS
7. TRANSFER STAND

Figure 1. Motor Storage and Handling Equipment

MOTOR STORAGE FACILITIES AT HILL AIR FORCE BASE (HAFB), UTAH



EXTERIOR VIEW OF STORAGE IGLOO



INTERIOR VIEW OF STORAGE IGLOO SHOWING MOTOR ON TRANSFER STAND AND TRANSFER PALLET IN FOREGROUND

Figure 2. Motor Storage Facilities at HAFB, Utah

4. Task (3). Implementation of task (3) is described in Phase II of the Motor Storage Studies Program Plan.

B. TASK REQUIREMENT, WING II AND WING IV MOTORS

1. General. The objectives and the implementation of the Follow-On R & D Storage Program and the motor handling, inspection, and testing procedures for the six Wing II and four Wing IV motors will essentially follow those delineated for the Wing I motors, as specified in this Program Plan. The exception is in the area of motor procurement. (Refer to paragraph 2, below, and Section III, B.6.) The tasks set forth in Section II of Work Statement to Contract AF 04(694)-127 call for the manufacture of six Wing II and four Wing IV replacement motors.

2. Source of Wing II and Wing IV Motors. The 10 motors in the Follow-On R & D Storage Program will be withdrawn from among operational missiles during cycling through the Depot Maintenance Facility (DFM) at HAFB, Utah. The storage motors will be selected from the first 36 Wing II and first 24 Wing IV motors cast. Hercules will manufacture six additional Wing II production contract motors and four additional Wing IV motors on Contract AF 04(694)-127. These units will be used as replacements for the stage III motors removed from the missiles.

3. Program Ground Rules. The following informal ground rules have been established as particularly applicable to the program:

(a) Complete the motor exchanges as early as possible

(b) Transfer motors to Follow-On R & D Motor Storage Program that have not had components removed or damaged

(c) Provide the replacement units to HAFB between June 1963 and July 1964

(d) Obtain the first two motors from operational spares No. 687 and No. 706

SECTION III

STEPS IN LIFE CYCLE OF STORAGE MOTOR

A. HANDLING, INSPECTION, AND TEST SEQUENCE FOR STORAGE MOTORS

1. Introduction. In accordance with procedures designed in STL Document GM 61-9734.2-1045, Guide for Aging Program, Full-Scale Minuteman Motors, dated 2 October 1961, Hercules has developed a handling, inspection, and test sequence for each stage III Minuteman rocket motor assigned to the Motor Storage Program. The sequence is designed for determining aging characteristics and storage capability.

2. Summary. Steps in the inspection and test sequence, discussed at length in this section, are summarized in the subparagraphs below. (See Figure 3.)

a. Step 1. The storage motor is manufactured at Hercules Bacchus Works in accordance with designated flight motor configuration. The test request is issued.

b. Step 2. The motor is given an initial inspection and NDT tests.

c. Step 3. Motor is shipped to the storage site at HAFB, Utah.

d. Step 4. The motor is placed in its temperature and humidity controlled storage bay in either vertical or horizontal position. Inspection for absence of visual defects is made initially and every 2 mo during storage. A log is kept of all inspection results.

e. Step 5. The motor is returned to Bacchus Works after the scheduled storage period.

f. Step 6. The motor is inspected thoroughly upon arrival at Bacchus Works to determine and document any changes resulting from storage.

g. Step 7. The motor is subjected to transportation conditioning, including vibration, by means of a spaced-board course or a electromechanical vibrator.

h. Step 8. Motor is reinspected to determine and document any changes resulting from the transportation conditioning.

i. Step 9. A Firing Test Plan is issued and the storage motor is instrumented and test fired.

j. Step 10. The fired motors are given a post-firing inspection to document any possible aging effects revealed by the firing.

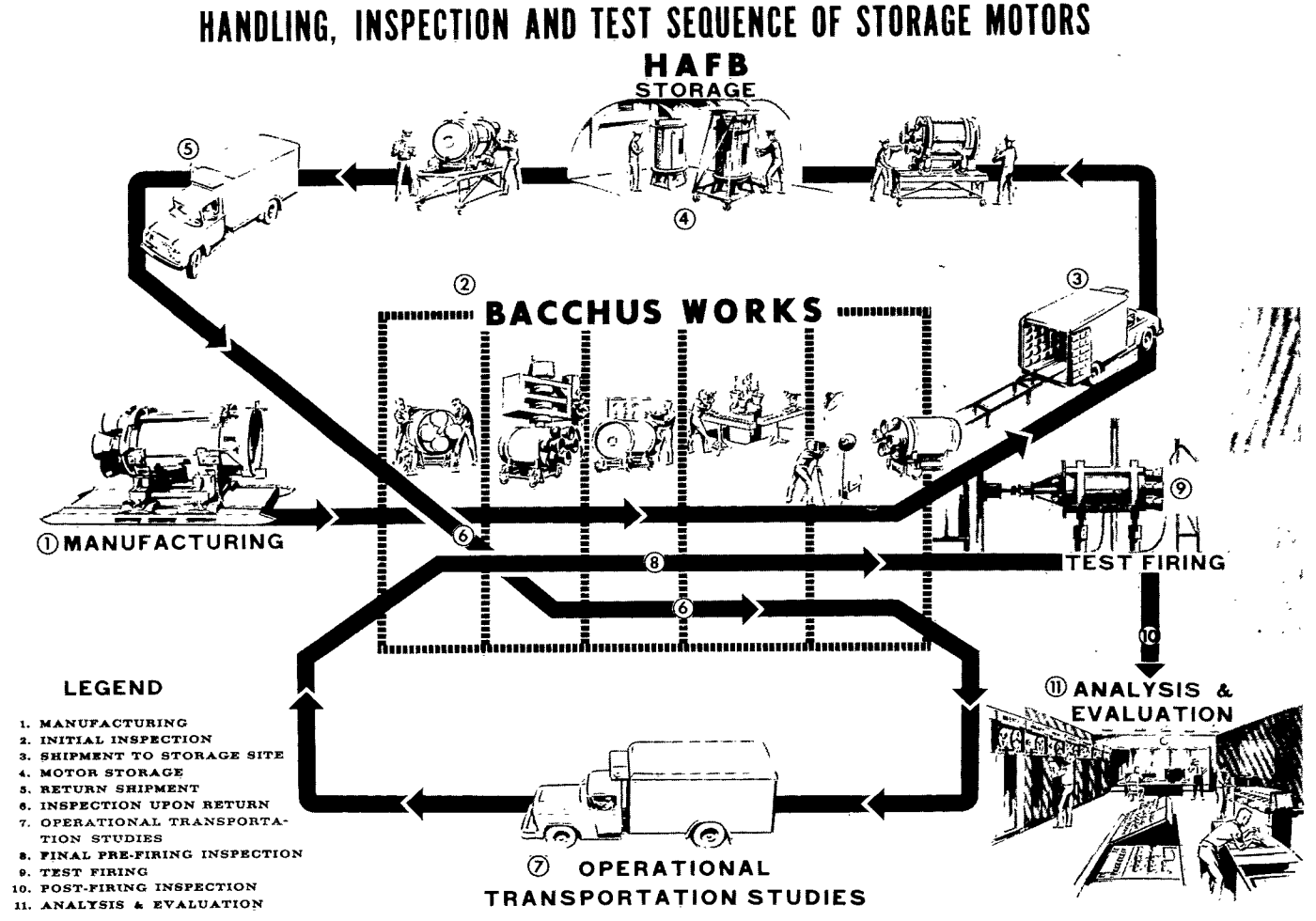


Figure 3. Handling, Inspection, and Test Sequence for Storage Motor

k. Step 11. Reports are submitted on completion of firing. All data generated during the life of the individual motor, including final firing data, are analyzed and interpreted to establish aging characteristics and storage capabilities of motors in the operational environment.

B. STEP 1, MOTOR MANUFACTURE AND PROCUREMENT

1. General. The following paragraphs describe storage motor manufacture, configuration and acceptance, documentation, and unit identification. A Storage Motor Configuration and Status Summary is also included as Table I.

2. Manufacture of Wing I Motors. Motors designated for storage were fabricated and completely assembled at Bacchus Works. Following manufacture and preparation of necessary documentation on each individual motor, initial inspection was performed and the motor transported to the storage site.

a. Storage Motor Configuration and Acceptance.

1) Configuration Definition. The configuration for motors used in the Hercules Motor Storage Program is defined by the Wing I Storage Motor Configuration and Status Summary presented as Table I. In general, each motor in the program has the same configuration as the block of flight motors referenced in Table I with the exception of flight instrumentation and deviations, as recorded in the Motor Log Book.

2) Design Deviations. Planned design deviations from the referenced flight configuration, such as selection of flight instrumentation, use of sea-level nozzles, deletion of destruct systems, etc., shall be listed in the individual Test Request. (Refer to paragraph 3, below.) Other actual physical changes in the motor, such as those noted in the Quality Audit Report, shall be reviewed by the Air Force Plant Office. The criteria for the approval of these changes shall be that they will not compromise the storage program objectives.

b. Post Manufacture Configuration Changes. The pyrotechnic igniter, originally scheduled for Wing I motors, did not meet the required reliability level and consequently was replaced by the more reliable pyrogen igniter. This configuration change was made after a part of the storage motors had been stored. Because failure of the igniter during firing would prevent acquisition of pertinent storage data, a post-manufacture configuration change was recommended for all storage motors with pyrotechnic igniters. Authority for accomplishing the required igniter exchange was given in CCN No. 165 to Contract AF 04(647)-243. This CCN states that the igniter exchange will be made when the motors in storage are cycled through the Hercules facility for radiographic inspection. Table I lists the motors requiring the igniter exchange.

TABLE I

WING I STORAGE MOTOR CONFIGURATION AND STATUS SUMMARY

Motor Test Number	Storage Motor Serial No.	Case Number	Grain Number	FTM Config	Casting Date	Storage Attitude	Scheduled Storage Time	Firing Date	Road Test	Simulated Hardware	
										NCU	Exit Cone
243B-1-5-1	SP1	T402-16	113	403	24 Nov 60	V	1	Mar 62			
243B-1-5-2	MT.03**	T402.12	112	403	19 Nov 60	V	6	Nov 66	X	X	X
243B-1-5-3	SP3	T402-17	119	403	22 Dec 60	H	2	Jan 63	X		
243B-1-5-4	SP4	T402.66	120	504	23 Dec 60	H	1-1/2	Jun 62			
243B-1-5-5	SP5	T402.68	137	403	13 Mar 61	V	1-1/2	Sep 62	X		
243B-1-5-6	SP6	T402.74	150	403	30 Apr 61	V	2	May 63	X		X
243B-1-5-7	SP2	T402.72	151	403	2 May 61	V	10	May 71	X	X	X
243B-1-5-8	SP8	T402.36	163	403	9 Jun 61	V	2-1/2	Dec 63	X	X	X
243B-1-5-9	SP9	T402.38	164	403	12 Jun 61	V	8	Jun 69	X	X	X
243B-1-5-10	SP10*	T402.02	92	401	3 Sep 60	H	2-1/2	Apr 63			
243B-1-5-11	SP11	R202.59	259	402	15 Apr 62	V	3	Apr 65	X	X	
243B-1-5-12	SP12	R202.07	176	405	8 Sep 62	H	3	Sep 64	X	X	
243B-1-5-14	SP14	R206H.10	240	409	18 Feb 62	V	4	Feb 66	X	X	
243B-1-5-15	SP15	R205X.60	243	409	1 Mar 62	V	5	Mar 67	X	X	
243B-1-5-20	SP7	T402.23	129	403	26 Jan 61	H	1	Dec 61	X***		

*Flight Motor No. 0030002 was returned from AMR and was assigned as Storage Motor No. 10.

**Motor MT .03, originally assigned to the Mobile Program, was reassigned as a storage motor when the Mobile Program was discontinued.

***10,000 Mile Road Test

TABLE I (Cont)

WING I STORAGE MOTOR CONFIGURATION AND STATUS SUMMARY

Motor Test Number	Igniter D/N Installed at Manufacture	Pyrogen Igniter Installed at Retro-Fit	Date of Installation	Igniter S & A D/N Installed at Manufacture	Igniter S & A D/N Installed At Retro-Fit	TT S & A D/N	Nozzle D/N	Nozzle Expansion Ratio
243B-1-5-1	2075	Fired with pellet igniter		2600		7300-3	3934	8:1
243B-1-5-2	2075			2600	KR80000-03	2729	3934	8:1
243B-1-5-3	2075	01A00560-003	15 Dec 62	2600	KR80000-03	2729	3934	8:1
243B-1-5-4	2075	Fired with pellet igniter		2600		2729	3934	8:1
243B-1-5-5	7734-1	01A00560-003	20 Aug 62	KR80000-03		7300-3	3934	8:1
243B-1-5-6	7734-1		*	KR80000-03		7300-3	3934	8:1
243B-1-5-7	7734-1		*	KR80000-03		7300-3	3934	8:1
243B-1-5-8	7734-1		*	KR80000-03		7300-3	3934	8:1
243B-1-5-9	7734-1		*	KR80000-03		7300-3	3934	8:1
243B-1-5-10	2075	01A00560-003	25 Mar 63	2600	KR80000-03	LM2729	3933	18:1
243B-1-5-11	01A00560-003			KR80000-04		7300-5	6354	6:1
243B-1-5-12	7734-1		*	KR80000-03		7300-3	6354	6:1
243B-1-5-14	7734-1		*	KR80000-04		7300-3	6354	6:1
243B-1-5-15	01A00560-003			KR80000-04		7300-5	6354	6:1
243B-1-5-20	2075-1	Fired with pellet igniter		2600			3933	18:1

*To be retro-fit by June 1963

3. Storage Test Request.

a. Description. In accordance with STL Document GM 61-9734.2-1045, Revision 1 (paragraph E (1), Section I), Hercules will prepare a Test Request for each storage motor. Although CCN No. 108 refers to this document as Detailed Test Plan the title, Test Request, is considered more descriptive and in closer harmony with Air Force designation; it, therefore, will be used throughout the Motor Storage Program. Each Test Request will be submitted to AFBSD for review and approval 10 days prior to initiation of storage, and will include the following:

(1) A summary motor log containing an approved motor configuration parts list, list of as-built drawings, certification of quality of motor and components, motor weight and balance data, and predicted ballistic parameters

Note

The Motor Log Book is a separate document incorporated into each Test Request by reference. It is formally reviewed and approved by the Air Force Plant Office prior to shipment of the motor to the storage facility at HAFB.

(2) Manufacturing dates of major components and subassemblies

(3) Definitive information on planned storage conditions

(4) Inspection and test schedule, as well as an outline

4. Supplemental Motor Log Book. A Supplemental Motor Log Book will be kept by Hercules for each storage motor. This record will include all NDT results, inspection check sheets, Production Work Orders, Failure Reports, and Event Records completed after manufacture. Test plans, Test Requests, environmental records, transportation conditioning records, shipping documentation, and transportation logs will also be included.

5. Government Furnished Equipment (GFE). Provisions will be made for delivery, as required, of the following GFE: (Motors will be stored and tested without installation of GFE when items are unavailable.)

	Item	Contractor
(a)	Raceway covers	The Boeing Company
(b)	Base recirculation shield	The Boeing Company
(c)	Cable harness	Autonetics

6. Unit Motor Identification. Surveillance storage motor serial numbers with SP prefix (Table I) are given for Wing I storage motors inasmuch as the first storage motors with attendant documentation were marked with SP numbers. Wing II and Wing IV motors used in the Follow-On R & D Storage Program will be identified by their respective motor serial numbers and motor test numbers.

7. Procurement of Wing II and Wing IV Motors.

a. Motor Selection. The 10 motors in the Follow-On Storage Program will be removed from operational missiles during cycling through the DMF at HAFB, Utah. The storage motors will be selected from the first 36 Wing II and first 24 Wing IV motors cast at the time these motors are first cycled through the DMF. Hercules will manufacture six additional Wing II production contract motors and four additional Wing IV motors on Contract AF 04(694)-127. These units will replace the stage III motors removed from missiles during recycle. Selection of the motors will be based on the following:

(1) None of the following components shall have been removed after motor manufacture:

(a) Igniter

(b) Igniter S & A

(c) Nozzles

(d) Elements of the TT assembly

(2) The motors shall have sustained no damage that would require replacement of any of the components listed in (1) above.

(3) The motor shall not have been subjected to environments outside of the limits specified in Model Specification S-133-1003-0-1.

(4) A complete motor history shall be available, including the Plant 77 and the launch site motor histories.

b. Scheduled Exchanges. The first two motors will be obtained from operational spares No. 687 and No. 706. These exchanges will occur in June and July 1963, respectively. The remaining exchanges will be effected during regular missile recycle.

c. Exchange Procedure.

1) Manufacturing, Inspection, and Shipping of the Replacement Motor. Six Wing II and four Wing IV replacement motors will be

manufactured, given a complete inspection, and accepted by HPC/AFQC prior to transfer to HAFB, Utah. Each motor will be mounted in an operational harness, shipped to HAFB (Building 1832, 1833, or 1835) and stored until required for motor exchange. The Form DD 250, used for the motor acceptance, will include the following statements:

(a) "Accountability of this motor to remain AFH 1321 AF 04(694)-127."

(b) "Above item to be used as a replacement motor."

(c) "No transfer of accountability involved."

2) Documentation Exchange. Ten days prior to the expected motor recycle date, Ogden Air Materiel Area (OOAMA) will notify the Hercules OOAMA Field Service Representative that one of the motors from the group primarily selected is to be recycled. This notification should also give the reason for recycling and the approximate arrival time at the DMF. A copy of the Motor Log Book, including all the failure and discrepancy reports issued on the selected motor, will also be transmitted by OOAMA to the Hercules representative. If the selected motor meets the acceptance criteria, Hercules will initiate a Form DD 1149 transferring the replacement motor to the HAFB account, AFU 2020. The form will be signed by a responsible officer of the Airmunitions IM Management (YISM). This form gives OOAMA authority to ship the replacement motor to the recyle facility. YISM will, in turn, transit to the Hercules OOAMA Field Service Representative for signature a Form 1348, transferring the accountability of the selected motor to the Hercules account, AFH 1321. Signature of the form 1348 will constitute Hercules acceptance and will provide Hercules with the authority to ship the selected motor to the Bacchus Works.

3) Component Exchange. The components on the selected motor shall be identical to the components on the replacement motor at the time the motor is received at the DMF. To obtain the required component similarity, the following necessary component exchanges will be accomplished by OOAMA prior to shipping the selected motor to Bacchus Works:

(a) Components to be removed from the selected motor:

(1) Nozzle control unit

(2) Aft interstage kick ring

(3) Autonetics raceway cabling

(4) Boeing raceway cover

(5) Boeing supplied TT cabling support bracket

(b) Components to be installed on the selected motors:

(1) Nozzle shipping links

(2) Raceway shipping cover

(3) Nozzle dust covers

(4) TT switch and S & A connector protective caps

Note

Except for those compounds listed above, no components are to be removed. The selected motor is to remain in the operational harness.

d. Motor Shipment and Inspection. The selected motor will be shipped to Bacchus Works and inspected in accordance with paragraph C.

e. Motor Test Request. A Test Request is executed at the time of motor selection. Hercules will submit the Test Request to AFBSD/STL when the motor selection is made.

C. STEP 2, INITIAL MOTOR INSPECTION AND TESTING

1. Inspection and Testing Areas. Each Wing I storage motor will be initially inspected following manufacture. Each Wing II and Wing IV motor will be inspected prior to shipment to the storage site in accordance with the Test Request. All inspections are to be conducted without removal of the igniter, igniter S & A, TT wiring harness, or nozzles. The inspection and testing areas include:

(a) Visual examination of the motor

(b) Radiographic inspection of the propellant grain and propellant bond interfaces

(c) Electrical inspection of applicable ordnance components

(d) Determination of nozzle actuation characteristics

(e) Photographs of motor showing condition of motor components such as nozzles, external insulation, etc.

(f) Weight and center of gravity determination

(g) Nozzle alignment and position measurements

2. Visual Examination of the Storage Motor. The visual examination given each storage motor at the initial inspection point is in accordance with standard Hercules quality control procedures. The visual examination will be conducted to determine that none of the following forms of failure are present:

(a) Formation of surface cracks or abnormal condition of propellant surface or other internal surfaces

(b) Separation of the raceway and cover attachment from each other or from the case

(c) Change in safe and arm device position

(d) Seepage of O-ring lubricant from O-ring seals

(e) Corrosion of components

(f) Cracking, crazing, separation, or bulging of external insulation

(g) Discrepancies in nozzle bore and blast tube surfaces

3. Radiographic Inspection of the Propellant Grain and Propellant Bond Interfaces. Each storage motor will be radiographically inspected during initial inspection in accordance with standard Hercules procedure. The purpose of this type inspection is to determine that none of the following types of failure are present:

(a) Void formation within the propellant

(b) Separations between propellant and liner

(c) Surface cracks on propellant

(d) Propellant creep within configuration

(e) Delamination, crazing, or bulging of the case

4. Electrical Inspection of Pertinent Ordnance Components. The igniter safe and arm device, as well as the thrust terminator ARM/DISARM switch, will undergo checkout during this initial inspection and testing period. This inspection will be made in accordance with Hercules Standard Inspection Procedures.

5. Determination of Nozzle Actuation Characteristics. The nozzle actuation characteristics will be determined to ensure that no discrepancies exist and to provide reference data for comparison with future nozzle actuation tests. The nozzle actuation characteristics are measured mechanically by applying a force to the nozzle and calculating the torque required to actuate the ball joint.

6. Photographs of Motor Showing Condition of Exposed Components. Photographs will be taken of the general exterior of the motor as a documentary record of original condition should any future handling damage or appearing aging defects be discovered. Photographs will document nozzles, external insulation, and other exposed components.

7. Weight and Center of Gravity Determination. The motor weight and center of gravity will be determined during the period of initial motor inspection and testing to determine changes in grain configuration. Determination will be made in accordance with AS 60-306-2, Aero Science Inc, operational manual, Weight and Center of Gravity Measurement System.

8. Nozzle Alignment and Position Measurements.

a. Technique Application. A means for making nozzle alignment and position measurements has been devised to ascertain whether change with time occurs in the position of the nozzle. This measuring technique, not available at the time the Wing I motors were manufactured, is necessarily applied when the motors are cycled through the Bacchus plant for installation of the simulated flight hardware, as described in Step 4, paragraph E. Initial measurements for the Wing II and Wing IV motors will be obtained when the motors are returned to Bacchus for the prestorage inspection. (Refer to paragraph B.)

b. Necessary Modifications. To accomplish the nozzle position inspection with present gauging equipment, it will be necessary to remove nozzle control unit (NCU) mounting pads and drill an index hole so that the motors conform to later configuration. The improved gauging operation is described by Hercules SOP's.

D. STEP 3, MOTOR SHIPMENT

1. Enroute Observations. Upon successful termination of the inspection and testing described in paragraph C the motor will be transported to the storage site at HAFB, Utah. The motor will be transported in an approved harness and transporter similar to those used for transport of operational motors, which will maintain the temperature, humidity, and shock environments within specified limits. The temperature, humidity, and motor vibration will be recorded during transportation to determine the environment experienced by the motor. Continuous monitoring will be maintained to observe any change in the motor's condition.

2. Handling and Transportation Procedures Documentation. Handling and transportation of the motor from Bacchus Works to HAFB will be accomplished in accordance with applicable procedures contained in Hercules Technical Manual HPC-133-03-5-1, Transportation and Handling of Minuteman M-57E1 Third Stage Rocket Motor, dated 1 May 1962.

3. Transportation Equipment. The motor will be transported in an insulated temperature and humidity controlled aluminum van mounted on a Dodge RC500-145 chassis. (See Figure 4.) The transporter contains a refrigeration-heating unit, designed to maintain temperature at 70° F ± 10°, and a Boeing alarm system to provide a record of shock loading during motor transfer.

4. Motor Handling Equipment. Wing I motors will be mounted in a Surveillance Storage Harness, Hercules drawing No. 4936 BU. Wing II and Wing IV motors will be mounted in a Universal Handling and Inspection Harness, Hercules drawing no. 01E00993. The mounted motors are then secured in a modified Boeing Airplane Company (BAC) Shipping Harness, Hercules drawing no. 6538 BU, for shipment.

5. Movement of Classified Type III, Class A Explosive. Storage motors shipped to the HAFB storage site will be shipped with igniters, safe and arm devices, and destruct packages installed as Type III, Class A Explosive. During shipment the motor will be monitored constantly to ensure that all safety factors are observed.

E. STEP 4, MOTOR STORAGE

1. General. This step describes the storage disposition of the motor upon its arrival at the storage site. A synopsis precedes a detailed accounting of off-plant storage procedures, accountability of motors during storage, and areas of responsibility.

2. Motor Storage Procedures, Synopsis. Upon the motor's arrival at HAFB, Utah, current SOP's will be followed in transferring the completely assembled motor from the transporter to its assigned storage facility. Installation procedures utilize special handling equipment and trained personnel. The personnel are responsible for knowing and following these procedures, including safety precautions, as described in applicable SOP's. In the storage position, the motor will be placed in a fixed vertical attitude with nozzle end down or positioned horizontally, as shown in Figures 1 and 2. Following the initial examination, the motor is thereafter given a visual examination every 2 mo during storage. Temperature and humidity records of the storage facility will be monitored at least weekly by Air Force personnel and examined in detail monthly by Hercules personnel.

3. Placement of Motor in Storage.

a. Transfer Equipment. The motor at this time is mounted in two harnesses. (Wing I motors are mounted in the surveillance harness and modified BAC harness; Wing II and Wing IV motors in the universal harness and modified BAC harness.) The motor is placed in its assigned storage facility by Air Force and Hercules personnel, using the following transfer equipment: (See Figures 1 and 2.)

Figure 4. Transporter

(1) Transfer stand

(2) Transfer pallet

(3) 20-ton crane

(4) Cable sling

(5) Bridge rails

b. Transfer Procedure. The motor is transferred from the operational transporter into its assigned storage igloo in accordance with the following steps:

(1) The transfer stand is connected to the transporter by means of the bridge rails. The motor is then rolled out onto the transfer stand from the transporter.

(2) The BAC harness, secured by the cable sling, is then lifted up from the transfer stand and lowered onto the transfer pallet by the crane.

(3) The motor on the transfer pallet is then moved by hand into the storage igloo.

(4) Once in the storage igloo, the motor is transferred from the modified BAC shipping harness to either the Horizontal or Vertical Storage Stands, Hercules drawing no. 4936 and 5036 by means of the portable transfer stand.

(5) The harness is removed from the vertical motors after being placed in the stand. The motors stored horizontally remain in either the surveillance storage harness or universal handling harness.

4. Master Schedule for Wing I Motors. Table III depicts casting dates, storage designations, and firing dates for the Wing I motors assigned to the storage program. This table also represents the Wing I test matrix. Further information on Wing I motor configurations is given in Table I.

5. Test Matrix for Wing II and Wing IV Motors. Table III represents the test matrix for the Wing II and Wing IV motors. Serial numbers and casting, storage, and firing dates of these motors cannot be given because of the motor selection method. (Refer to Section III, paragraph B.7.) Approximate dates, however, can be determined from the predicted casting dates given in Table III. Wing II and Wing IV motors will be stored vertically.

TABLE II

MASTER SCHEDULE FOR WING I STORAGE MOTORS

Test No.	Casting Date	Into Permanent Storage (HAFB)	Test Firing Date	Storage Time (yr)	Storage Attitude (vertical or horizontal)
243B-1-5-1	24 Nov 60	13 May 61	Mar 62	1	V
243B-1-5-20	26 Jan 61	--*	Dec 61	1	H
243B-1-5-5	13 Mar 61	24 Nov 61	Oct 62	1 1/2	V
243B-1-5-4	23 Dec 60	28 Sep 61	Jun 62	1 1/2	H
243B-1-5-6	30 Apr 61	6 Apr 62	May 63	2	V
243B-1-5-3	22 Dec 60	15 Sep 61	Jan 63	2	H
243B-1-5-2	19 Nov 60	13 Jul 61	Nov 66	6	V
243B-1-5-8	9 Jun 61	10 Apr 62	Dec 63	2 1/2	V
243B-1-5-9	12 Jun 61	27 Apr 62	Jun 69	8	V
243B-1-5-10	3 Sep 60	29 Dec 61	Apr 63	2 1/2	H
243B-1-5-11	15 Apr 62	30 Oct 62	Apr 65	3	V
243B-1-5-12	8 Sep 61	12 Apr 62	Sep 64	3	H
243B-1-5-14	18 Feb 62	24 Aug 62	Feb 66	4	V
243B-1-5-15	1 Mar 62	16 Aug 62	Mar 67	5	V
243B-1-5-7	2 May 61	17 Apr 62	May 71	10	V

*Aged 1 year but not stored at HAFB (This motor was manufactured for the Mobile Test Program but reassigned to the Motor Storage Program.)

TABLE III

WING II AND WING IV MOTOR STORAGE MATRIX

Motor Configuration	Storage Time (Years)					
	1	1-1/2	2	2-1/2	3	5
Wing II	X	X	X	X	X	X
Wing IV	X		X		X	X

X - Indicates a motor withdrawal for transportation conditioning and test firing

Note: (1) All motors are to be stored vertically.

(2) Predicted casting dates are:

(a) Wing II: Between Jan 62 and Mar 63

(b) Wing IV: Between Oct 63 and Dec 63

6. Commencement of Storage Life. A motor being manufactured for storage may be unable to meet its scheduled storage date because of priority reallocations of parts or material, rescheduling of rejected parts, or other reasons. The time from manufacture to storage of a given motor may be many months. A method of computing this pre-storage time into storage life of individual motors is, therefore, necessary. All motors are always handled in accordance with the temperature and exposure limits established in Hercules specifications with failure reports noting any exceptions. Thus, computing storage time from casting date allows an estimate of storage life that considers handling and pre-storage environments. Any deviation from the temperature and exposure limits will, of necessity, be used in the final evaluation of motor performance.

7. Environmental Control of the Motor During Storage. Motors are stored under conditions simulating hardened and dispersed environments. The motors, in permanent-type storage facilities that approximate actual silo conditions, can closely experience the aging characteristics of operational missiles. Approximations of silo conditions, including storage attitude of motors, plus temperature and humidity environment, are discussed in paragraphs a through c below.

a. Simulating Silo Storage. Motors are stored in a vertical position, nozzle end down, in the simulation of hardened and dispersed environment. Static loads applied to the motors in the silos are simulated in the storage igloo by placing a Simulated Re-entry Vehicle Weight, Hercules drawing No. 4882, on the motor and supporting the motor on the aft interstage ring. To approximate actual operational conditions,

Simulated NCU's, drawing No. 01E01028, and Simulated Flight Nozzle Exit Cones, Hercules drawing No. 01E00818, are placed on the motors. (Simulated NCU's and nozzle exit cones were not available when the Wing I motors were manufactured. As a result some of the motors were tested without this equipment. Table I indicates the Wing I motors equipped with the simulated flight hardware. All Wing II and Wing IV motors will be equipped with simulated NCU's at the time they are first cycled through Bacchus Works for inspection. These motors will not require simulated exit cones, since they were manufactured with flight nozzles.)

b. Depot Storage. To determine the effect of long-term horizontal storage on the Stage III motor, five of the Wing I motors are stored horizontally. The motor, mounted in the surveillance storage harness, is held in position by means of a Horizontal Storage Stand, Hercules drawing no. 4937. Tables II and III give the vertical or horizontal storage attitude which each Wing I, Wing II, and Wing IV motor will undergo during its designated storage period.

c. Temperature and Humidity Environment. The motors are stored at a minimum temperature of 60° F and a maximum temperature of 80° F. The relative humidity does not exceed 60 percent when the temperature is at 60° F, or 45 percent at a temperature of 80° F. The relative humidity does not exceed that indicated by a straight line drawn on a psychrometric chart between two points representing the temperature limits.

8. Inspection of Motors During Storage.

a. Performance. Inspection of the storage motors is performed when they are received and then throughout the storage period to provide a continual documentation of the effects of storage and transportation. These inspections are limited to visual and dimensional checks which can be conducted without removing the nozzles, igniter, igniter S & A device, or elements of the TT system. Documentary photographs are taken of the motor at the time it is received at the storage site. During storage the motors are not shifted or removed from the storage cell for routine inspections.

b. Inspection Criteria. Inspection operations to be performed during the prestorage and bimonthly inspections at HAFB will be as follows:

(1) The Spiralloy case will be visually examined to ensure there are no indications of deterioration, including cracks, breaks, chips, delamination, crazing, and bulging.

(2) The external insulation will be visually examined for absence of general deterioration and damage from supporting harness, bonding secureness to metal access hole covers, and bonding secureness to Spiralloy case.

(3) The metal accessory components will be examined for absence of corrosion and fatigue.

(4) The raceway covers will be examined for secureness of bonding to the Spiralloy case.

(5) The interstage structure will be examined for general quality integrity.

c. Propellant Creep Measurement. A device has been fabricated which facilitates measurement of the propellant grain wing slots. The instrument utilizes a linear potentiometer instrumented to provide a read-out of dimensional changes from the original wing slot dimension. This measurement provides a method of verifying the propellant grain rigidity. The measuring device is inserted into the grain through the nozzle. As the instrument is moved through the wing slot, the dimensional changes are observed. If an out-of-tolerance change is observed, the approximate position of the out-of-tolerance area and change is recorded and compared with previous measurements. Out-of-tolerance areas will be measured during subsequent inspections to determine whether a trend is developing.

9. Documentation of Inspection Data. All inspections performed are carefully documented by means of a Storage Motor Inspection Record. This record is completed bimonthly in accordance with established inspection procedures and included in the Supplemental Motor Log Book. Sample inspection record forms are included as Appendix A.

10. Accountability of Motors. All Wing I storage motors will be shipped to HAFB, Utah, using Air Force Form DD 250, shipping invoice, marked "No Transfer of Accountability Involved." Accountability of the Wing II and Wing IV motors, selected for the Follow-On R & D Motor Storage Program, will be transferred to Hercules by OOAMA on a Form DD 1348 at the time of the motor exchange.

11. Responsibilities for Handling and Storage of Motors at HAFB. Responsibilities for handling and storage of motors at HAFB, Utah, is as shown in paragraphs a and b below.

a. Hercules Responsibility. It will be the responsibility of Hercules personnel to meet the conveying transporter at HAFB to assist in storing the motor. Minimally, assistance will be rendered in the following areas:

(1) Assure conformance with applicable SOP's describing placement of the motor in storage.

(2) Assist Air Force personnel in any phase of the motor handling operation where such assistance may be requested or mutually beneficial.

(3) Visually monitor all transfer movements to help prevent any damage to the motor and record any damage, however minor, that might occur during the motor transfer from transporter into storage igloo.

HAFB Responsibilities. Personnel of HAFB will assume .ies for the handling and storage of motors as follows:

(1) Provide necessary technically skilled personnel and equipment to accomplish transfer of motors from transporters to buildings, in accordance with Hercules operating procedures.

(2) Furnish SOP's, manuals, or regulations for establishing security and safety in the storage area.

(3) Furnish the necessary personnel to maintain the security and safety required by HAFB regulations or procedures.

(4) Provide suitable lighting in the storage facility and surrounding area to accomplish motor transfer operations.

(5) Furnish, maintain, and monitor temperature and humidity recording devices to obtain continuous records of the motor environment during storage. These records will then be periodically delivered to Hercules for detailed monthly examination.

(6) Provide necessary standard hand tools upon request to assure proper motor transfer or implacement.

12. Storage Facilities.

a. Permanent Type. Permanent storage facilities for all motors are in the 1800 area at HAFB, Utah. Buildings scheduled for this use are Buildings 1825, 1826, 1832, 1833, 1834, and 1835. These concrete, dirt-covered igloos (Figures 1 and 2) are 20-ft w.de by 60-ft long, and are equipped with heating and air conditioning equipment to maintain the temperature and humidity levels required to simulate silo environments. Specifications and drawings for these igloos are contained in US Army Corps of Engineers' Specification, Serial No. ENG-04-203-F1-142. The buildings contain a built-in alarm system which notifies Air Force personnel immediately when igloo temperature exceeds the specified limit.

b. Interim Facilities. If unforeseen circumstances prevent storage in a permanent facility upon the motor's arrival at HAFB, the motor

will be temporarily assigned to an interim storage bay. Bays 3, 4, 5, 6, 7, or 8 of Building 2114 will be used for this purpose.

13. Motor Safety Mechanisms Utilized During Storage.

a. At the Permanent Storage Facility. Devices to render the motors nonpropulsive in the event of ignition during storage have been included in the design of the storage equipment. These devices consist of spikes mounted at the head end of the case. In the event of accidental propulsion, the spikes would be driven into the case, causing immediate rupture.

b. At the Interim Storage Facility. In event a motor is temporarily stored in the interim storage facility, frangible sectors will be removed from the TT snap rings on each of the TT port closures. This measure, if necessitated, will reduce thrust to zero after a fraction of the normal action time. Safety mechanisms for the interim storage in Building 2114, in the form of motor tiedowns, will be provided. Details of the tiedown system will be given in the Surveillance Program Procedures Manual to be published by Hercules approximately December 1963 as a supplement to this Motor Storage Studies Program Plan.

14. Removal of Motors from Storage Prior to the Prescribed Time.

a. Delamination, Bond, or Structural Failure of Motors. The motor will be removed from storage and destroyed should its case and structural system fail to a point where the structural rigidity necessary to perform normal handling or firing operations is not present. Before any motor is destroyed, however, studies will be performed to determine the cause of failure.

b. Special On-Plant Inspection. If the bimonthly visual inspection should disclose that a condition existed that might be hazardous or question advisability of further storage for any reason, the motor upon approval will be returned to Bacchus Works. Radiographic or other nondestructive testing will be made for determination of ultimate destruction, modification, return to storage, or other disposition.

c. Removal from Storage for Rework. Removal from storage will be necessary for the motors requiring igniter retro-fit or installation of simulated NCU's and flight nozzle exit cones. The rework required by the various motors is given in Table I. The motors will be given a complete inspection as described in paragraph C, before and after the rework operation. The required rework on the Wing I motors should be completed and the motors returned to the storage site by 1 June 1963.

F. STEP 5, RETURN SHIPMENT OF THE STORED MOTOR TO BACCHUS WORKS

1. Disposition. When a motor has been aged for the scheduled time, it is removed from storage and returned to Bacchus Works for transportation studies and static firing.

2. Transportation Arrangements. Hercules will arrange for the return transportation of the motor to Bacchus Works as described in paragraph C. While the motor is being transported, the temperature, humidity, and motor vibration will be recorded to determine the environment experienced by the motor.

G. STEP 6, MOTOR INSPECTION UPON RETURN TO BACCHUS WORKS

1. Purpose and Procedure. When the motor is returned to Bacchus Works from storage, it is again thoroughly inspected to determine, and document, any changes resulting from storage, handling, or transportation. The inspection is conducted in a manner similar to that performed prior to the motor's shipment to the storage facility. This visual inspection and nondestructive testing sequence includes a complete radiographic examination of the internal structure of the grain, weight and center of gravity determination, examination of nozzle torque, electrical checkout of ordnance devices, and other checks as detailed in paragraph C. The inspection procedures are the same as in paragraph C.

2. Motor Disposition and Elimination Criteria. Should critical defects render a storage motor unacceptable for operational transportation studies and static firing, it will be disassembled and sectioned, subject to AFBSD/STL approval. Disassembling and sectioning will be to determine propellant-to-case bond strength, internal dimensions, chemical composition of propellant, O-ring degradation, and corrosion of metal and non-metal parts.

H. STEP 7, OPERATIONAL TRANSPORTATION CONDITIONING

1. Conditioning Methods. After return to Bacchus Works and inspection as described in paragraph G, each storage motor will be subjected to operational transportation conditioning. This conditioning is designed to simulate the transportation that a Stage III operational motor might experience. The conditioning includes: (1) transportation over 1500 mi of highway and (2) transportation over a spaced-board bump course. The second test is designed to provide vibration exceeding that which operational motors will normally receive in transport.

2. Highway Transportation.

a. Description of Course. The motor will be transported 1500 mi over local highways in a manner simulating operational conditions. The course will be made up of short routes beginning and ending at Bacchus Works. Repeated runs will be made until a total of 1500 mi has been traveled. The transporter (Figure 4) will be driven at approximately 40 mph, depending on road conditions as judged by the accompanying test engineer.

b. Daily Log. The test engineer will maintain a detailed transportation account, the Daily Log Book, during the entire conditioning cycle. The following information will be logged:

(1) Road conditions when vibrational data are recorded

(2) Date, time, and mileage when data are recorded

(3) Information resulting from periodic visual inspection of the motor, harness, and transporter

(4) Unusual events

c. Pretrip Inspection. Before each run the motor, harness, transporter, and electronic equipment will be inspected visually as follows:

(1) Motor and harness will be inspected to ensure that the motor is secure. If adjustments are necessary, they will be recorded in the Daily Log Book.

(2) General condition of the motor will be investigated, and any indication of degradation recorded.

(3) Electronic equipment will undergo functional examination to ensure proper operation.

d. Electronic Data Recording. Electronic data will be recorded periodically throughout conditioning. The test engineer will decide what portion of the road will yield pertinent vibrational data, note the road condition in the Daily Log Book, and trigger manually the data acquisition equipment. This procedure will include, but will not be limited to, data samples of all long uniform stretches of highway, taken at least every 30 min. Data on unusual road conditions, such as washboarding and bridge crossing, will be recorded completely.

3. Space-Board Course Conditioning.

a. Description of Course. The purpose of the space-board course is to produce a steady state of vibrational loading at 1 to 1-1/2 g. To produce this loading, the motor transporter (Figure 4) will be driven repeatedly over the course. The course is built of 3/4-in. plywood with cross ribs spaced on approximately 24-in. centers throughout the length of the course. The cross ribs are 3/4-in. thick by 6-in. wide by 8-ft long.

b. Method of Achieving Required Load Levels. For effective spaced-board conditioning, the interim shipping harness suspension system will be blocked out, permitting an acceleration level of 1 to 1-1/2 g. Blocking out is achieved by placing a block between the axle and motor saddle support at each shock absorber and clamping the support and axle together with a V-clamp. This cancels shock absorbtion and creates a direct connection between the frame and motor saddle support.

c. Conditioning Procedure. The transporter, with motor and harness loaded, will be driven over the spaced-board course at a speed calculated to obtain the count of 1 to 1-1/2 g. Previous tests have determined that the desired speed is between 13 and 14 mph. This speed will provide 30 to 45 counts per trip. The transporter will be driven over the board course 30 times to accumulate a loading total of 1000 counts.

d. Log Book Entries. The test engineer will maintain the Daily Log Book during the spaced-board course conditioning. The following information will be recorded:

(1) Condition of the course at time of test

(2) Conditioning date and time

(3) Results of periodic visual inspection of the motor, harness, and transporter

(4) Unusual events

4. Instrumentation and Data Acquisition.

a. Equipment. The vibrational loading on the motor during highway and spaced-board course conditioning will be measured by 12 accelerometers mounted on the motor, harness, and transporter by means of special mounting blocks according to Hercules drawing no. 01D01499. The following instrumentation and recording equipment will be used:

(1) Electrically-powered, manually-triggered, 12-channel oscillograph

(2) Boeing alarm system, to provide a record of shock loading during all transfer, handling, and conditioning processes

Note

The Boeing alarm system is also used during conditioning runs to correlate accelerometer readings to g loading by making a constant record of shock readings in 1-g increments.

(3) One 14-channel frequency modulation tape transport with appropriate support equipment to serve as a data acquisition backup system

(4) Miscellaneous electrical equipment to integrate various instrumentation systems

b. Instrument Calibration. The accuracy of the accelerometers will be verified before each conditioning cycle, and calibrated on the calibration course at the Bacchus Works in accordance with the manufacturer's and Hercules' requirements. A record of the calibration data for each instrument will be maintained.

c. Data Reduction and Analysis. Following the completion of the cycle, the instrumentation will be removed. The conditioning data will be analyzed briefly. If it appears that the vibrational loading has affected the motor, the conditioning data will be analyzed in detail. Oscillograph records will be maintained until 6 mo after the motor has been fired.

5. Transportation and Handling Equipment. On both highway and spaced-board conditioning courses the motor will be mounted in an Interim Shipping Harness, BAC drawing no. 25-16834, and transported in an insulated aluminum van as described in paragraph D. (See Figure 4.) The transporter is approximately the size of a 1-1/2 ton truck and is equipped with rails, tie-downs, and shocks to secure the motor. The transporter also contains the following equipment:

(1) Means of transmitting vibrational data to accompanying data acquisition equipment

(2) Refrigeration-heating unit designed to maintain constant temperature

6. Instrument Carrier. The data acquisition equipment is transported in a 4-wheeled trailer, towed by the transporter during highway conditioning and by an accompanying truck during the spaced-board course conditioning. The truck is used to prevent the extreme vibrational loading of the spaced-board course from being transmitted directly to the oscillograph.

7. Vibration Testing in Lieu of Spaced-Board Road Testing. As authorized for Stage III motors in STL Document 6120-8825-CD000, Qualification Test Requirements for Wing II Minuteman Motors, dated 4 June 1962, vibration testing may be used to replace spaced-board road testing upon approval by BSD/STL. If utilized, instrumentation, pretest and post-test inspections, and tests shall be the same for Stage III vibration tests as for the spaced-board road test.

I. STEP 8, FINAL PREFIRING INSPECTION OF STORAGE MOTORS

1. Purpose. Each storage motor must receive a final inspection to document possible motor change resulting from the transportation conditioning and to determine its suitability for firing. The final inspection is the same as that described in paragraph C.

2. Motor Disposition and Elimination Criteria. Should a motor be considered unacceptable for static firing because of critical defects, it will be disassembled and sectioned, subject to AFBSD/STL approval, as mentioned in paragraph G. Purpose of this action will be to determine propellant and O-ring degradation, and corrosion of metal and nonmetal parts.

3. Removal of Simulated Flight Hardware. If final inspection indicates that storage and conditioning of the motor has not precluded its static-firing capabilities, the simulated flight hardware will be removed. The motor will then be scheduled for static test firing, as described in paragraph J.

J. STEP 9, TEST FIRING

1. Procedure Guide. The motor will undergo static firing when it has passed the final inspection. The instrumentation, pretest conditioning, and static firing of the motor will be performed in accordance with the individual Motor Test Plan. Hercules report MTO-25-3, Preliminary Flight Rating Test Plan, Rocket Engine XM-57, dated 30 September 1960, as amended by incorporation of applicable pages of report MTO-25-4, Revision 4 to the Preliminary Flight Rating Test Plan, dated 25 October 1960, will be used as a guide in preparing the test plan. This document presents procedural test data on: test structures, instrumentation and camera coverage, motor environmental temperature control, motor weight and center of gravity, inspection methods, environmental tests, data reduction and instrumentation, and calibration.

2. Component Removal. Components and ordnance devices installed on the motors will not be removed prior to firing unless the removal has been approved by BSD/STL. If component removal is required, it will be indicated in the test plan along with the reason for the removal. The Wing II and Wing IV motors which are procured with flight nozzles will be test fired with flight nozzles.

3. Instrumentation and Measurement. The motors will be instrumented before static firing. The major instrumentation and the measurements to be obtained are listed in Table IV. Detailed instrumentation lists and instructions are given in the test plan for each individual motor. Advancement of the state of the art of instrumentation and motor performance measurement may make available more accurate data-gathering devices; therefore, this portion of the test plan may be revised periodically to reflect the latest changes and advancements.

4. Nozzle Vectoring. The nozzles will be vectored by means of a remote NCU system. The nozzles will be vectored prior to and during the static testing in accordance with the Wing I Nozzle Movement Schedule (Table V) and Wing II and Wing IV Nozzle Movement Schedule (Table VI). Nozzle torque values will be recorded during both vectoring operations.

5. Static Testing.

a. Test Structures. Static testing will be accomplished in accordance with the test plan for the individual motor and the applicable Hercules Range Procedures. Test structures for use in firing storage motors are given in Section I of Hercules Report MTO-25-3 and MTO-25-4. (Refer to paragraph 1.)

b. Pretest Conditioning. Prior to firing, the motors will be conditioned for 4 days at 60° F, and all units will be fired at 60° F.

c. Thrust Termination. The thrust termination system will be activated within 5 sec after motor burnout.

d. Documentation. Hercules will issue after-firing reports, documenting test firing results on individual, aged motors.

1) Quick-Look Report. Hercules will issue a Quick-Look Report 10 days after each firing giving a brief summary of ballistic performance, including test objectives. This report will also include a brief postfiring description and a resume of success or failure of the motor firing.

2) Final Firing Report. The final Firing Report will be issued by Hercules 30 days after each firing. The report will contain a detailed analysis of each motor firing and will incorporate and summarize essential data from other submitted reports. This data will include test objectives, test configuration, test procedure, instrumentation, test schedule, and motor configuration.

K. STEP 10, POSTFIRING INSPECTION

1. Inspection and Analysis. After static firing, each motor will be analyzed according to Hercules Postfire Analysis Procedure for stage III Minuteman motors. This procedure establishes standard analysis and handling procedures for use with fired Minuteman motor hardware and ensures that all data that are available are used in the analysis of fired hardware. The fired motor is subjected to the following inspections:

(a) After firing photographs

(b) Weight and center of gravity

(c) Visual examination of nozzles, ignition system, thrust termination system, case, internal insulation, and external insulation

2. Final Measurement and Observations. The motor is disassembled after the inspection described in paragraph 1 above, and the final measurements and observations are made on the following:

TABLE IV

STATIC FIRING INSTRUMENTATION
TO BE INSTALLED ON STORAGE MOTORS

Measurement Number	Type of Measurement	Type of Transducer	Location or Installation Drawing	Priority	Purpose of Measurement
P-1	Motor chamber pressure	Taber no. 206SA 0 to 500 psi	01S01290	1	Monitor motor chamber pressure
P-2	Motor chamber pressure	CEC no. 4329-0100 0 to 500 psi	01S01290	1	Monitor motor chamber pressure
P-3	Motor chamber pressure	CEC no. 170326-0100 (operational) 0 to 500 psi	01S01290	1	Monitor motor chamber pressure
F-4A	Axial thrust	Alinco no. 344, 0 to 25,000 lb	01S01181	1	Monitor axial thrust
F-4B	Axial thrust	Alinco no. 344, 0 to 25,000 lb	01S01181	1	Monitor axial thrust
F-5A	Axial thrust	Alinco no. 344, 0 to 25,000 lb	01S01181	1	Monitor axial thrust
F-5B	Axial thrust	Alinco no. 344, 0 to 25,000 lb	01S01181	1	Monitor axial thrust
F-6A	Forward	Alinco no. 344, 0 to 2000 lb	Figure 1	1	Correlate force with nozzle-position data
F-6B	Forward side force	Alinco no. 344, 0 to 2000 lb	Figure 1	2	Correlate force with nozzle-position data
F-7A	Aft side force	Alinco no. 344, 0 to 2000 lb	Not available	1	Correlate force with nozzle-position data
F-7B	Aft side force	Alinco no. 344, 0 to 2000 lb	Not available	2	Correlate force with nozzle-position data
F-8A	Forward vertical force	Alinco no. 344, 0 to 5000 lb	Not available	1	Correlate force with nozzle-position data
F-8B	Forward vertical force	Alinco no. 344, 0 to 5000 lb	Not available	2	Correlate force with nozzle-position data

TABLE IV (Cont)

STATIC FIRING INSTRUMENTATION
TO BE INSTALLED ON STORAGE MOTORS

Measurement Number	Type of Measurement	Type of Transducer	Location or Installation Drawing	Priority	Purpose of Measurement
F-9A	Aft vertical force	Alinco no. 344, 0 to 5000 lb	Not available	1	Correlate force with nozzle-position data
F-9B	Aft vertical force	Alinco no. 344, 0 to 5000 lb	Not available	2	Correlate force with nozzle-position data
F-10A	Roll force	Alinco no. 344, 0 to 3000 lb	Not available	1	Correlate force with nozzle-position data
F-10B	Roll force	Alinco no. 344, 0 to 3000 lb	Not available	2	Correlate force with nozzle-position data
TC-11	Grain temperature	I/C thermocouple	01S00913	2	Monitor grain temperature prior to firing
E-12	Ignition current (event)	Not available	Not available	1	Monitor ignition current event
E-13	TT current event	Shunt resistor	Firing line	2	Monitor TT current event
E-14	Event	Breakwire resistor	TT port 1	2	Determine frangible sector simultaneity
E-15	Event	Breakwire resistor	TT port 2	2	Determine frangible sector simultaneity
E-16	Event	Breakwire resistor	TT port 3	2	Determine frangible sector simultaneity
E-17	Event	Breakwire resistor	TT port 4	2	Determine frangible sector simultaneity
AF-27-1	Actuator force	Ormond no. SP-112, 0 to 1000 lb	Actuator arm link 1	2	Monitor actuator force
AF-27-2	Actuator force	Ormand no. SP-112, 0 to 1000 lb	Actuator arm link 2	2	Monitor actuator force
AF-27-3	Acutator force	Ormond no. SP-112, 0 to 1000 lb	Actuator arm link 3	2	Monitor actuator force
AF-27-4	Actuator force	Ormond no. SP-112, 0 to 1000 lb	Actuator arm link 4	2	Monitor actuator force

TABLE V

NOZZLE MOVEMENT SCHEDULE, WING I

Time (sec)	Pitch Nozzles	Yaw Nozzles	Roll Nozzles
0 to 5	Fixed at 0^{o}	Fixed at 0^{o}	None
5 to 10	$\pm 4^{o}$ at 0.5 cps	$\pm 4^{o}$ at 0.5 cps in phase with pitch motion	None
10 to 15	Fixed at 2^{o}	Fixed at 0^{o}	None
15 to 20	Fixed at 0^{o}	Fixed at 2^{o}	None
20 to 25	$\pm 2^{o}$ at 0.5 cps	$\pm 2^{o}$ at 0.5 cps in phase with pitch motion	None
25 to 30	$\pm 2^{o}$ at 0.5 cps	0	None
30 to 35	$\pm 1^{o}$ at 2 cps	$\pm 1^{o}$ at 2 cps in phase with pitch motion	None
35 to 40	Fixed at -1^{o}	Fixed at -1^{o}	None
40 to 45	$\pm 1^{o}$ at 1 cps	$\pm 1^{o}$ at 1 cps in phase with pitch motion	None
45 to 50	$\pm 2^{o}$ at 0.5 cps	$\pm 2^{o}$ at 0.5 cps in phase with pitch motion	None
50 to 60	$\pm 1^{o}$ at 1 cps	$\pm 1^{o}$ at 1 cps in phase with pitch motion	None

TABLE VI

NOZZLE MOVEMENT SCHEDULE, WING II AND WING IV

Time (sec)	Pitch Nozzles	Yaw Nozzles	Roll Nozzles
0 to 5	$\pm 4^{o}$ at 0.5 CPS	$\pm 4^{o}$ at 0.5 CPS in phase with pitch motion	None
5 to 10	$\pm 2^{o}$ at 1 CPS	$\pm 2^{o}$ at 1 CPS in phase with pitch motion	None
10 to 15	Fixed at $+ 2^{o}$	Fixed at 0^{o}	None
15 to 20	Fixed at 0^{o}	Fixed at 2^{o}	None
20 to 25	$\pm 2^{o}$ at 0.5 CPS	$\pm 2^{o}$ at 0.5 CPS in phase with pitch motion	None
25 to 30	$\pm 2^{o}$ at 0.5 CPS	0	Nozzle No. 3 $\pm 2^{o}$ at 0.5 CPS in phase with pitch motion Nozzle No. 1 fixed at 0^{o}
30 to 35	$\pm 1^{o}$ at 2 CPS	$\pm 1^{o}$ at 2 CPS in phase with pitch motion	None
35 to 40	Fixed at -1^{o}	Fixed at -1^{o}	None
40 to 45	$\pm 2^{o}$ at 0.5 CPS	$\pm 2^{o}$ at 0.5 CPS in phase with pitch motion	None
45 to t_a	$\pm 1^{o}$ at 1 CPS	$\pm 1^{o}$ at 1 CPS in phase with pitch motion	None

Notes:

(1) The above movement schedule is an input schedule from the programmer.
(2) $\pm$ indicates sinusoidal motion.
(3) In TT tests, the movable nozzles shall be in a neutral position at the time of TT.
(4) When a phase III NCU is used, there will not be a roll command. Nozzle 3 command will be the same as nozzle 1 command.
(5) t_a is when the thrust descends to 750 lb.

(a) Nozzles

(b) Ignition system

(c) TT system

(d) Internal insulator

(e) External insulation

(f) Case

L. STEP 11, ANALYSIS AND INTERPRETATION OF DATA

1. Restatement of Objectives. As stated in Section II, paragraph A.3.a, the overall objectives of the Motor Storage Program are to evaluate the storage behavior of the stage III Minuteman motor under environmental conditions representative of the operational status, and ultimately aid in the prediction of the usable life of operationally deployed motors. Specific objectives are:

(a) To determine early data on the useful and safe storage life of the stage III rocket motor

(b) To determine the reliability degradation of aged motors

(c) To determine parts failure and the replacement and rework intervals to be used in establishing field recall and service intervals for the operational missile

(d) To determine upon storage the effect of transportation on the motor

2. Data Evaluation.

a. Motor Storage Program. To translate the implemented objectives into usable conclusions, Hercules will perform, in accordance with CCN No. 108, analysis of full-scale motor and laboratory data for the interpretation of the motor aging characteristics and storage capability. These data are accumulative, growing out of the various phases of the Motor Storage and Surveillance Support Programs. The terminal data pertaining to the Motor Storage Program phase are based on the life of the stored, transported, and fired motor, and will be analyzed to interpret motor aging characteristics and storage capability.

b. Surveillance Support Program. As further indicated in an equivalent section of the Surveillance Support Program, data evaluation and interpretation is to be a joint effort, taking into consideration related points of all phases of the program.

3. Evaluation of Motor Inspection Data Preliminary to Static Firing. The data obtained from the periodic motor inspections during storage at HAFB will be evaluated for each motor prior to static firing. The purpose of the evaluation is to determine the areas which have shown degradation and which will require monitoring during static firing.

4. Comparison and Evaluation of Firing Data. Data developed from the Wing I motor static firing will be compared to PFRT data, and Wing II and Wing IV motor static firing data will be compared to data recorded on Wing II and Wing IV qualification motors to determine degradation of the measured parameters and to establish the reliability of the aged motor. Components of design different from PFRT will be evaluated separately, using data obtained from motors of a similar configuration. If failure occurs during static firing, the evaluation will proceed as depicted in Figure 5.

5. Individual Motor Final Test Report. As required in STL Document GM 61-9734.2-1045, Revision 1, Hercules will prepare an Individual Motor Final Test Report on each motor. This report will include:

(a) Summary of test handling and inspection operations

(b) Review of test objectives

(c) Description of test events and system performance

(d) Post-test inspection data

(e) Detailed conclusions

(f) Reliability classification of subsystems as to success or failure

(g) Detailed recommendations

(h) An appendix, discussing correlation of test results with applicable laboratory, subassembly, and subscale tests

6. Data Reduction. Data from storage motor firings will be reduced in accordance with Section VIII of Hercules report MTO-25-3.

7. Testing and Firing Reports (Program Status Reports). The results of all testing and static firing will be reported in the applicable monthly Reliability and Failure Report, which is issued in accordance with the requirements of Exhibit B to Contract AF 04(647)-243. Quarterly and annual comparison of data and static firing reports for storage motors will also be published in the Reliability and Failure Report, together with conclusions concerning storage-life reliability degradation.

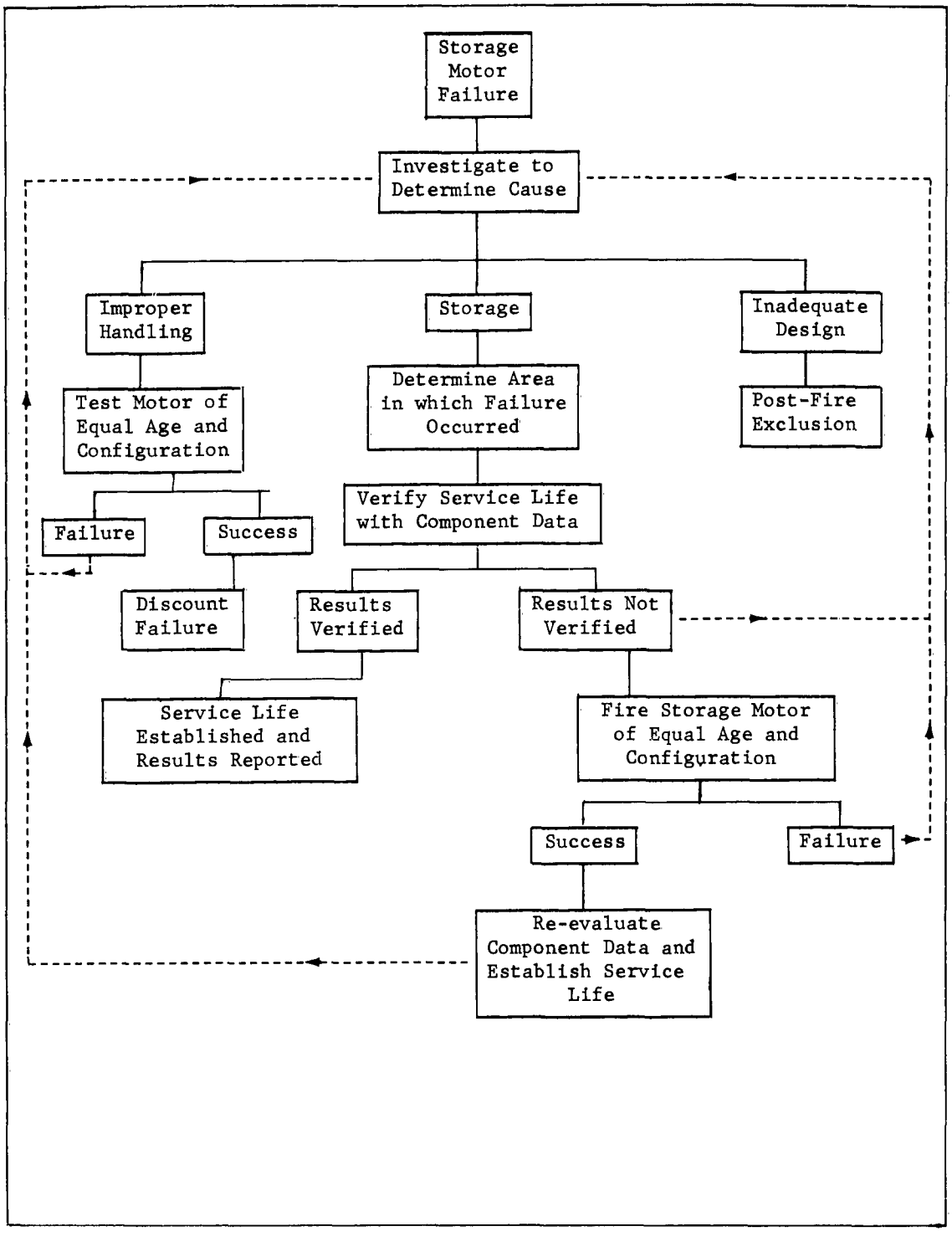


Figure 5. Storage Motor Failure Evaluation Procedure

8. Summary Report. A summary report will be issued quarterly. This report will cover the following:

(a) All completed tests will be summarized and discussed with respect to meeting the objectives of the program.

(b) A complete summary of conclusions and recommendations will be presented.

APPENDIX A

SAMPLE INSPECTION RECORD FORMS

STORAGE MOTOR INSPECTION RECORD

INSPECTOR _____

DATE	LOCATION	MOTOR NO.		R E NUMBER	NOTES
	CHECKLIST No. 1 - Transportation and Handling				
1.	The required equipment for motor transfer and handling is not available or in proper repair.				
2.	The portable crane is not located in the proper position for motor transfer.				
3.	Motor is not properly covered for transfer in inclement weather.				
4.	Operational transporter or portable loading stand is not properly stabilized or secured for transfer operation.				
5.	Transfer from operational transporter to portable loading stand is accomplished according to Standard Operating Procedure.				
6.	Motor is bumped with the cable sling during unloading operation.				
7.	The motor is stopped abruptly or the maximum rate is exceeded while being lowered to the transfer pallet.				
8.	The motor instead of the modified harness is used for pushing during transfer from loading site to storage location in the igloo.				
9.	The transfer pallet is rolled over an obstacle or object which subjects the motor to vibration.				
10.	The motor is bumped with the Trunnion lifting adapters or other equipment during transfer to storage position.				

STORAGE MOTOR INSPECTION RECORD

INSPECTOR_____

DATE	LOCATION	MOTOR NO.	✓	R E NUMBER	NOTES
CHECKLIST No. 2 - Inspection of Storage Facilities					
1. Indication of moisture seepage into storage facilities is evident by wet spots, puddles, etc.					
2. Indication of dust leakage into storage facility is evident by examination of area next to sealed doorway.					
3. The sealing strip on the doorway appears defective due to hardening, torn sections, unbonded sections, etc.					
4. Mechanical devices for operating and locking doorway appears defective.					
5. Evidence of damage exists on temperature and humidity monitoring devices.					
6. Evidence of damage exists on vents and air ducts.					
7. Interior lighting is defective or not in proper repair					

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STORAGE MOTOR INSPECTION RECORD

INSPECTOR_____

DATE	LOCATION	MOTOR NO.		R E NUMBER	NOTES
CHECKLIST No. 3-Storage Motor Quality Assurance					
1.	Tags containing nozzle alignment dimensions are not securely attached to the nozzle exit cone.				
2.	Safing wires on bolts are broken or damaged.				
3.	The igniter Safe and Arm Manual pin is not in place.				
4.	Seepage of propellant ingredients is evident in nozzle port.				
5.	Seepage of O-ring lubricant is evident on igniter base plate or on igniter Safe and Arm Device.				
6.	The nozzle exit cone is cracked or broken.				
7.	The nozzle exit cone is bulging or shows evidence of bond separation.				
8.	The nozzle exit cone is chipped, scratched or cut.				
9.	The base recirculation insulation surface is cracked or broken.				
10.	The base recirculation insulation surface is bulging.				
11.	The base recirculation insulation surface is shipped, scratched or torn.				
12.	The base recirculation is not bonded securely to the spirallov case.				
13.	The nozzle boot or nozzle potting compound is cracked or torn.				
14.	The nozzle potting compound is not securely bonded in place.				
15.	Corrosion is evident on Igniter Safe and Arm.				
16.	Corrosion is evident on Igniter Base Plate.				
17.	Corrosion is evident on Aft Center Port Retaining Ring.				C10-114

STORAGE MOTOR INSPECTION RECORD

INSPECTOR

DATE	LOCATION	MOTOR NO.		R E NUMBER	NOTES
(Continued) CHECKLIST No. 3 - Storage Motor Quality Assurance					
18.	Corrosion is evident on Nozzle Actuator Bracket.				
19.	Corrosion is evident on Surface of NCU Mounting Pads or in threaded bolt holes.				
20.	Corrosion is evident on mating interface surface of the aft interstage ring.				
21.	The aft interstage skirt of the spiralloy case is cracked or broken.				
22.	The aft interstage skirt of the spiralloy case is bulging or shows evidence of delamination.				
23.	The aft interstage skirt of the spiralloy case is chipped, scratched or cut.				
24.	Raceways are not bonded securely to the spiralloy case.				
25.	The external case insulation surface is cracked or broken.				
26.	The external case insulation surface is bulging.				
27.	The external case insulation surface is chipped, scratched or torn.				
28.	The external case insulation is not bonded securely to the metal access hole covers.				
29.	The external case insulation is not bonded securely to the Spiralloy Case.				
30.	The external Case insulation shows evidence of creep. Note: Check particularly in area where motor weight is supported by harness.				
31.	Damage is evident on areas of external insulation which could penetrate deep enough to have damaged the spiralloy case.				
32.	The forward dome of the spiralloy case is cracked or broken.				
33.	The forward dome of the spiralloy case is bulging or shows evidence of delamination.				
34.	The forward dome of the spiralloy case is chipped, scratched or cut.				C10-114

STORAGE MOTOR INSPECTION RECORD

INSPECTOR

DATE	LOCATION	MOTOR NO.		R E NUMBER	NOTES
(Continued) CHECKLIST No. 3 -Storage Motor Quality Assurance					
35. The forward interstage skirt of the spiralloy case is cracked or broken.					
36. The forward interstage skirt of the spiralloy case is bulging or shows evidence of delamination.					
37. The forward interstage skirt of the spiralloy case is chipped, scratched or cut.					
38. The T.T. Safe and Arm Manual pin is not in place.					
39. The T.T. wiring harness is not held in place properly by holding clamps.					
40. Protective caps are not in place or are missing from open electrical connectors.					
41. Electrical connectors are not tied down.					
42. Corrosion is evident on Destruct Safe and Arm Mounting Bracket.					
43. Corrosion is evident on Raceway Reinforcing Plate.					
44. Corrosion is evident on Nut Plates in raceways or nut is frozen or restricted from its design movement within the Nut Plate.					
45. Corrosion is evident on Nut Plates in Forward Interstage Ring.					
46. Corrosion is evident on Nut Plates in Forward Skirt or nut is frozen or restricted from its designed movement within the nut Plates.					
47. Corrosion is evident on Cable Support Brackets in Forward Skirt.					
48. Corrosion is evident on Vent Assembly in Forward Skirt.					
49. Corrosion is evident on Cable Support Clip in Forward Skirt.					
50. Corrosion is evident on Wiring Connectors.					
51. Corrosion is evident on mating interface surface of the forward interstage ring.					C10-114

STORAGE MOTOR INSPECTION RECORD

INSPECTOR_____

DATE	LOCATION	MOTOR NO.		R E NUMBER	NOTES
(Continued) CHECKLIST No. 3-Storage Motor Quality Assurance					
52. Corrosion is evident on Forward Center Port.					
53. Corrosion is evident on Forward Center Port Retaining Ring.					
54. Corrosion is evident on Thrust Termination Safe and Arm.					
55. Corrosion is evident on Thrust Termination Safe and Arm Mounting Bracket.					

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